Attorney Docket No. 0756-2119

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:)
Hisashi OHTANI et al.)
Serial No. 09/550,598)
Filed: April 17, 2000)
For: SEMICONDUCTOR DEVICE AND)
PROCESS FOR PRODUCING THE)
SAME)

Group Art Unit: 2814
Examiner: P. Cao

CERTIFICATE OF MAILING
I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on 4-11-05.

Adelia M Stamps

APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In accordance with the provisions of 35 U.S.C. § 134 and 37 C.F.R. § 1.192(a), Appellants submit this Appeal Brief to appeal the examiner's final rejection of claims 1, 2, 4, 5, 7, 9, 11, 12, 14, 18 and 20-29 in the Official Action mailed May 18, 2004. A *Notice of Appeal* was filed October 18, 2004, and an *Advisory Action* was mailed November 3, 2004. An Appeal Brief was filed December 20, 2004. A *Notification of Non-Compliant Appeal Brief (37 CFR 41.37)* was mailed March 10, 2004.

TABLE OF CONTENTS

I. REAL PARTY IN INTEREST

The named inventors have assigned all ownership rights in the pending application to Semiconductor Energy Laboratory Co., Ltd., 398, Hase, Atsugi-shi, Kanagawa-ken, 243-0036, Japan, which is the real party in interest.

II. RELATED APPEALS AND INTERFERENCES

An appeal is now pending in related application Serial No. 09/197,767.

Aside from the above, the appellants, their legal representatives, and the assignee are not aware of any other prior or pending appeals, interferences or judicial proceedings which will directly affect or be directly affected by, or have a bearing on the Board's decision in this appeal.

III. STATUS OF THE CLAIMS

Claims 1, 2, 4, 5, 7, 9, 11, 12, 14, 18, 20-27 and 29 are pending in the present application, of which claims 1, 2, 4, 14 and 29 are independent. Claims 1, 2, 4, 5, 7, 9, 11, 12, 14, 18, 20-29 are rejected. Claims 3, 6, 8, 10, 13, 15-17, 19 and 28 were canceled. No claims have been deemed allowable by the examiner.

IV. STATUS OF AMENDMENTS

An *Amendment* under § 1.116 has been filed concurrently herewith which presents the rejected claims in better form for consideration on appeal (claim 28 has been canceled). The *Amendment* has been included in Appendix A. Thus, the status of the claims in this application is as set forth above and in Appendix A.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention relates to a method for producing a semiconductor device having an active matrix display device, comprising (1) forming a first conductive layer (e.g. 101; 201; 331, 332; 631, 632); (2) forming an insulating layer (e.g. 102; 202; 335, 337; 635, 637) (comprising an organic resin) over the first conductive layer; (3) forming an opening (e.g. 103; 203; 338, 339; 638, 639) in the insulating layer to expose the first conductive layer at a bottom of the opening; (4) forming an embedded conductive layer

comprising an organic resin (e.g. 104; 340; 341, 342; 905, 906), or forming an oxide conductive layer by a spin coating method (e.g. 204; 640; 641, 642; 1005, 1006); (5) etching, polishing or removing a portion of the embedded conductive layer to expose a portion of the insulating layer (e.g. paragraph [0088]), etching or polishing the oxide conductive layer to make a state in that only the opening is filled with the oxide conductive layer (e.g. Figures 1B and 2B), or etching the oxide conductive layer by using the second conductive layer as a mask in a self alignment manner (e.g. paragraph [0049] or [0056]); (6) forming a second conductive layer on (the insulating layer and) the embedded/oxide conductive layer; and (7) forming a pixel electrode (e.g. 343, 344; 643, 644; 901, 902; 1001, 1002) by patterning the second conductive layer, where the second conductive layer is light reflective.

Alternately, steps (4) through (7) may instead be as follows: (4') forming a second conductive layer (e.g. 105; 205) comprising a conductive oxide to cover the insulating layer and the opening; (5') polishing the second conductive layer by employing a chemical mechanical polishing (e.g. Example 4); and (6') forming a third conductive layer (e.g. 343, 344; 643, 644; 901, 902; 1001, 1002) on the insulating layer and the second conductive layer, where the third conductive layer is reflective.

Alternately, steps (4) through (7) may instead be as follows: (4") filling the opening with a second conductive layer comprising a conductive oxide to cover the insulating layer and the opening; and (5") forming a reflective pixel electrode (e.g. 343, 344; 643, 644; 901, 902; 1001, 1002) on the insulating layer, where the reflective pixel electrode is electrically connected to the first conductive layer through the second conductive layer.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Paragraph 2 of the Final Official Action rejects claims 1, 5, 7, 9, 14, 18 and 20-29 as obvious based on the combination of U.S. Patent No. 5,706,064 to Fukunaga et al., U.S. Patent No. 5,536,950 to Liu et al. and U.S. Patent No. 6,400,428 to Izumi. Paragraph 3 of the Final Official Action rejects claims 2 and 11 as obvious based on the combination of Fukunaga, Liu, Izumi, and U.S. Patent No. 6,221,140 to Kobayashi et al. Paragraph 4 of the Final Official Action rejects claims 4 and 12 as obvious based on the combination of Fukunaga, Izumi, U.S. Patent No. 5,948,705 to Jun and Kobayashi.

VII. ARGUMENTS

To establish a *prima facie* case of obviousness, (1) there must be some suggestion or motivation (either in the references themselves or in the knowledge generally available to one of ordinary skill in the art) to combine the reference teachings; (2) there must be a reasonable expectation of success; and (3) the prior art references when combined must teach or suggest all the claim limitations. See MPEP § 2142-43. Once a *prima facie* case of obviousness has been made by the Patent Office, the burden then shifts to Applicant to rebut that *prima facie* case. This rebuttal can include any arguments or presentation of evidence that is pertinent to the issue of unobviousness including, for example, comparison of test data showing unexpected properties not present in the prior art or that the prior art is so deficient that there is no motivation to make what might appear to be obvious changes. See In re Dillon, 16 U.S.P.Q.2d 1897, 1901 (Fed. Cir. 1990); MPEP § 2142. For the reasons that follow, it is respectfully submitted that a *prima facie* case of obviousness cannot be maintained in this application.

As noted in MPEP § 2142, the initial burden is on the examiner to provide some suggestion of the desirability of doing what the inventor has done. "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." Ex parte Clapp, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985). It is respectfully submitted that Fukunaga, Liu, Izumi, Kobayashi and Jun fail to expressly or impliedly suggest a light reflective pixel electrode or conductive layer in combination with the other features of the claims of the present application, and it is further submitted that the examiner has not presented a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references.

Also, it should be noted that the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also

suggests the desirability of the combination. In re Mills, 916 F.2d 680 (Fed. Cir. 1990). In other words, simply because the references can be combined does not mean that they should be combined. Thus, simply because one could combine and modify the teachings of Fukunaga, Liu, Izumi, Kobayashi and Jun, does not mean one of skill in the art would do so absent some suggestion of the desirability of doing so.

Fukunaga teaches a pixel electrode 412 used in a transmissive or transparent-type apparatus. For example, "transparent electrode 405 for electrochemical deposition and Cs storage forming are formed above the Cs line 403, and the contact between a source electrode 409 and a pixel electrode 412 is attained at contact portions 411a and 411b" (Example 4, Figure 17); "In the substrate for the display device shown in FIG. 19, the contact between a transparent electrode 405 for Cs, connected to a source electrode 409, and a pixel electrode 412 is obtained by a contact portion 411 of the functional layer," (Example 5); and "In the substrate (or array substrate) for the display device shown in FIG. 21, the contact between a transparent electrode 405 for Cs, connected to a source electrode 409, and a pixel electrode 412 is obtained by a conductive polymer embedded in a contact hole provided in the color filter layer" (Example 6). Fukunaga does not teach or suggest that pixel electrode 412 be used in a reflective-type device.

Liu is relied upon to allegedly teach planarization and does not teach or suggest reflective-type devices.

Izumi teaches that a pixel electrode 15 should be transparent "when used for a light transmitting type display device and that a pixel electrode 15 should be reflective "when used for a reflecting type display device" (column 6, lines 15-19).

The Final Official Action implicitly concedes that Fukunaga and Liu do not teach that transmissive-type pixel electrode 412 is light reflective (pages 5 and 8, Paper No. 21). The Final Official Action relies on Izumi to allegedly teach using either a transparent electrically conductive film or a reflective electrically conductive film with Fukunaga. Specifically, the Final Official Action asserts that "it also would have been obvious to form Fukunaga's pixel electrode being either a transparent electrically conductive film or a reflective electrically conductive film depending upon the display device type which is desired for the liquid crystal display device, as taught by Izumi

(column 6, lines 15-20)" (page 5, Paper No. 21). In other words, the Final Official Action appears to assert that it would have been obvious to modify or replace Fukunaga's transmissive-type pixel electrode 412 with Izumi's reflective-type pixel electrode 15. For the reasons stated in detail below, the Appellants respectfully disagree and traverse the above assertions in the Final Official Action.

The Final Official Action has not given any indication that one with ordinary skill in the art at the time of the invention would have had a reasonable expectation of success when combining Fukunaga, Liu and Izumi. Fukunaga discloses that "the R-, G-, B-colored portions 413 and the black matrix portion 414 become glass which has an insulating property" (column 26, lines 30-33). The Appellants respectfully submit that if the reflective conductive film of Izumi is applied to Fukunaga's display device, as suggested by the Final Official Action, then the R-, G-, B-colored portions could not be used as color filters. In other words, even if Fukunaga is combined with Liu and Izumi as suggested by the Final Official Action, since Fukunaga's device is required to be transmissive in order to allow the light to enter into the color filters, the resulting hypothetical combined structure of Fukunaga and Izumi could not function as a liquid crystal display device. In other words, nothing in Izumi teaches or suggests changing Fukunaga from a transmissive-type LCD to a reflective-type LCD. Therefore, the Appellants believe this rejection should be traversed.

Furthermore, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify Fukunaga, Liu and Izumi or to combine reference teachings to achieve the claimed invention.

Liu does not cure the deficiencies in the alleged motivation to combine Fukunaga and Izumi. The Final Official Action relies on Liu to allegedly teach "the steps of depositing the embedded conductive layer 82 in the opening [of Fukunaga], followed by planarization to expose the surface of the insulating layer 78 and depositing and patterning the pixel electrode 24 on the embedded conductive layer 82" (page 4, Id.). Liu does not show that one of ordinary skill in the art would have been motivated to combine Fukunaga and Izumi.

In the "Response to Arguments" section, Paragraph 5 of the Final Official Action asserts that "the combined teachings of the references would have suggested to those of ordinary skill in the art because Izumi clearly suggests that the display electrode of Fukunaga can have a pixel electrode made of either a transparent electrically conductive film or a reflective electrically conductive film depending upon the display device type which is desired for the liquid crystal display device (column 6, lines 15-20)" (page 6, Paper No. 0504). The Appellants respectfully disagree and traverse the above assertions in the Final Official Action.

Liu appears to teach that an aperture ratio is an important factor influencing the power requirement of an AMLCD, and Liu appears to have an object of increasing the aperture ratio (see column 1, lines 29-33, and column 2, lines 62-65). Liu clearly discloses that a transparent metal (ITO) is used as a pixel electrode (see column 5, lines 40-41). Also, Liu discloses that a high aperture ratio is achieved, and that the high aperture ratio allows use of a lower power backlight. In view of these disclosures, it is clearly understood that Liu's liquid crystal display device is a transmission type liquid crystal display device. Whether or not Izumi discloses that a pixel electrode is a transparent electrically conductive film or a reflective electrically conductive film (see column 6, lines 15-19), there is no proper suggestion or motivation that would have instructed one of ordinary skill in the art at the time of the present invention to change the pixel electrode of Liu in a transmission type liquid crystal display device to a reflective pixel electrode.

Furthermore, Izumi is directed to a liquid crystal device/display utilizing a plurality of adjoining display panels to form a single display screen and merely discloses that "[e]ach pixel electrode 15 is a transparent electrically conductive film made of ITO (Indium Tin Oxide) or the like when used for a light transmitting type display device and a reflective electrically conductive film made of aluminum (Al) or the like when used for a reflecting type display device" (column 6, lines 15-19, emphasis added). So, Izumi fails to teach any interchangeability between a light transmitting type display device and a reflecting type display device, much less such interchangeability for use as a pixel electrode.

In fact, Izumi teaches that a transparent electrically conductive film should be used for a light transmitting type display device. Since Fukunaga and Liu are directed to light transmitting type display devices, Izumi, in fact, teaches away from the present invention by teaching that a transparent film should be used with a light transmitting type display device. Therefore, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify Fukunaga, Liu and Izumi or to combine reference teachings to achieve the claimed invention.

The Appellants further contend that even assuming, *arguendo*, that the combination of Fukunaga, Liu and Izumi is proper, there is a lack of suggestion as to why a skilled artisan would use the proposed modifications to achieve the unobvious advantages first recognized by the Appellants. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.

The Advisory Action mailed November 3, 2004, asserts that the Appellants arguments are not persuasive for the following reasons:

> Izumi clearly teaches that a pixel electrode made of either a transparent electrically conductive film or a reflective electrically conductive film depending upon the display device type which is desired for the liquid crystal display device (column 6, lines 15-20). Specifically, Izumi suggests that a transparent pixel electrode made of transparent conductive film is used for a light transmitting type display device, and a reflective pixel electrode made of reflective conductive film is used for a reflective type display device. Therefore, from the teaching of Izumi, one skilled in the art would not apply the reflective pixel electrode into the transmitting type display device of Fukunaga as asserted by Applicant because it does not make any senses. In contrary, one skilled in the art would apply the transparent pixel electrode into the transmitting type display device, and apply the reflective pixel electrode to the reflective type display device, as taught by Izumi. In the other words, applying either transparent material or reflective material for pixel electrode structure disclosed by Fukunaga would be obvious because it is an intended use depending upon the type of the display device desired for the display. Thus, using reflective pixel electrode for reflective type display device and using transparent pixel electrode for transmitting type display device is a reasonable expectation of success. And again, in view of teachings of Izumi, applying the pixel electrode structure suggested from the combination of Fukunaga and Liu into the reflective type display

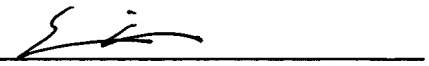
device or transmitting type display device would be obvious because it would depend on the conductive material, which is used for the pixel electrode.

The Examiner's arguments are not understood. It is not the case that Fukunaga is directed to a reflective-type device or that Izumi teaches the steps required to convert a transmissive-type device such as Fukunaga into a reflective-type device. Rather, Fukunaga teaches a pixel electrode 412 used in a transmissive or transparent-type apparatus, and Fukunaga does not teach or suggest that pixel electrode 412 be used in a reflective-type device. Izumi merely teaches that a pixel electrode 15 should be transparent for a light transmitting type display device and reflective for a reflecting type display device. It is unclear how the mere teaching of use of a reflective pixel electrode for a reflecting type display device is sufficient to motivate one of ordinary skill in the art to change the underlying transmissive nature of the Fukunaga device. In other words, Izumi does not teach or suggest that a reflective pixel electrode should be used in a transmitting type display device or vice-versa.

Therefore, it is respectfully asserted that the pending claims of the present application are unobvious in view of the prior art of record. Reversal of the outstanding rejections of record and allowance of the claims of this application is requested.

For all of the above reasons, the present application is believed to be in condition for allowance and favorable reconsideration is respectfully requested. If the Examiner feels further discussions would expedite prosecution of this application, the Examiner is invited to contact the undersigned.

Respectfully submitted,



Eric J. Robinson
Registration No. 38,285

Robinson Intellectual Property Law Office
PMB 955
21010 Southbank Street
Potomac Falls, VA 20165
(571) 434-6789
(571) 434-9499 (facsimile)

VIII. APPENDICES

APPENDIX A
PENDING CLAIMS

1. (Previously Presented) A method for producing a semiconductor device having an active matrix display device, comprising:

forming a first conductive layer;

forming an insulating layer comprising an organic resin over said first conductive layer;

forming an opening in said insulating layer to expose said first conductive layer at a bottom of said opening;

forming an embedded conductive layer comprising an organic resin to cover said insulating layer and said opening;

etching or polishing said embedded conductive layer to expose a portion of the insulating layer;

forming a second conductive layer on said insulating layer and said embedded conductive layer; and

forming a pixel electrode by patterning the second conductive layer, wherein said second conductive layer is light reflective.

2. (Previously Presented) A method for producing a semiconductor device having an active matrix display device, comprising:

forming a first conductive layer;

forming an insulating layer over said first conductive layer;

forming an opening in said insulating layer to expose said first conductive layer at a bottom of said opening;

forming an oxide conductive layer by a spin coating method to cover said insulating layer and said opening;

etching or polishing said oxide conductive layer to make a state in that only said opening is filled with said oxide conductive layer;

forming a second conductive layer on said insulating layer and said oxide conductive layer; and

forming a pixel electrode by patterning the second conductive layer, wherein said second conductive layer is light reflective.

3. (Canceled)

4. (Previously Presented) A method for producing a semiconductor device having an active matrix display device, comprising:

forming a first conductive layer;

forming an insulating layer over said first conductive layer;

forming an opening in said insulating layer to expose said first conductive layer at a bottom of said opening;

forming an oxide conductive layer by a spin coating method, to cover said insulating layer and said opening;

forming a second conductive layer on said oxide conductive layer;

patterning said second conductive layer to form a pixel electrode wherein said second conductive layer is light reflective; and

etching said oxide conductive layer by using said second conductive layer as a mask in a self alignment manner.

5. (Previously Presented) A method for producing a semiconductor device according to claim 1, wherein said embedded conductive layer comprises an organic resin film containing a conductive material dispersed therein.

6. (Canceled)

7. (Original) A method for producing a semiconductor device according to claim 5, wherein said conductive material is a carbon material.

8. (Canceled)

9. (Original) A method for producing a semiconductor device according to claim 5, wherein said conductive material is selected from the group consisting of zinc oxide, aluminum flakes and nickel flakes.

10. (Canceled)

11. (Original) A method for producing a semiconductor device according to claim 2, wherein said oxide conductive layer comprises indium tin oxide.

12. (Original) A method for producing a semiconductor device according to claim 4, wherein said oxide conductive layer comprises indium tin oxide.

13. (Canceled)

14. (Previously Presented) A method for producing a semiconductor device having an active matrix display device, comprising:

forming a first conductive layer;

forming an insulating layer over said first conductive layer;

forming an opening in said insulating layer to expose said first conductive layer at a bottom of said opening;

forming a second conductive layer comprising a conductive oxide to cover said insulating layer and said opening;

polishing said second conductive layer by employing a chemical mechanical polishing; and

forming a third conductive layer on said insulating layer and said second conductive layer,

wherein said third conductive layer is reflective.

15.-17. (Canceled)

18. (Previously Presented) A method for producing a semiconductor device according to claim 14, wherein said conductive oxide comprises a metal oxide.

19. (Canceled)

20. (Previously Presented) A method for producing a semiconductor device according to claim 1, 2, 4 or 14, wherein said semiconductor device is a cellular phone.

21. (Previously Presented) A method for producing a semiconductor device according to claim 1, 2, 4 or 14, wherein said semiconductor device is a camcorder.

22. (Previously Presented) A method for producing a semiconductor device according to claim 1, 2, 4 or 14, wherein said semiconductor device is a portable computer.

23. (Previously Presented) A method for producing a semiconductor device according to claim 1, 2, 4 or 14, wherein said semiconductor device is a head mounted display.

24. (Previously Presented) A method for producing a semiconductor device according to claim 1, 2, 4 or 14, wherein said semiconductor device is a rear type projector.

25. (Previously Presented) A method for producing a semiconductor device according to claim 1, 2, 4 or 14, wherein said semiconductor device is a front type projector.

26. (Previously Presented) A method for producing a semiconductor device according to claim 1, 2, 4 or 14, wherein said semiconductor device is an EL display device.

27. (Previously Presented) A method according to claim 1 wherein an exposed surface of the insulating layer is flush with the embedded conductive layer.

28. (Canceled)

29. (Previously Presented) A method for producing a semiconductor device having an active matrix display device, comprising:

forming a first conductive layer;

forming an insulating layer over said first conductive layer;

forming an opening in said insulating layer to expose said first conductive layer at a bottom of said opening;

filling said opening with a second conductive layer comprising a conductive oxide to cover said insulating layer and said opening; and

forming a reflective pixel electrode on the insulating layer, wherein said reflective pixel electrode is electrically connected to the first conductive layer through the second conductive layer.

APPENDIX B
REFERENCES

Copies attached.

APPENDIX C
EVIDENCE APPENDIX

Not applicable.

APPENDIX D
RELATED PROCCEDINGS APPENDIX

Not applicable. (No decision has yet been rendered by a court or the Board in the application identified in Section II above.)